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PROVISIONAL INTELLIGENCE REPORT

THE TANK AND ASSAULT GUN INDUSTRY OF THE USSR

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CIA/RR PR-25
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SECURITY INFORMATION

PROVISIONAL INTELLIGENCE REPORT

THE TANK AND ASSAULT GUN INDUSTRY OF THE USSR

CIA/RR PR-25

(ORR Project 31-51)

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THE TANK AND ASSAULT GUN INDUSTRY OF THE USSR*

Summary and Conclusions

The tank and assault gun industry of the USSR is closely related to the heavy equipment industry of the USSR. The weight and mobility of the Soviet tanks and assault guns that have gone into production during and since World War II require manufacturing facilities beyond the capabilities of the Soviet tractor and automotive industries, with which the development of the tank industry was associated up to World War II.

The production of tanks and assault guns in the USSR is highly centralized. Current Soviet production of tanks and assault guns is centered in six plant complexes -- three in the Urals area and one each at Khar'kov, Leningrad, and Omsk -- where it is carried on in close physical proximity to the production of heavy equipment, including locomotives. In these plant complexes, which themselves possess sizable steel production facilities, the capacity currently devoted to the production of heavy equipment could be reconverted quickly to the production of tanks and assault guns, for which it was used in World War II.

The history of the tank and assault gun industry of the USSR since World War II may be divided into three phases. The first phase, extending from 1945 to 1947, was a period of conversion to civilian production and of salvaging war material. The second phase, extending from 1947 to 1949, was utilized to refurbish plants designated for continued tank and/or assault gun production and to apply lessons learned during the war. The third phase, extending from 1949 to the present, saw serial production of the new T-54 medium tank, as well as the JS-III heavy tank, and the corresponding assault gun models.

Soviet production of tanks and assault guns, which totaled 18,118 units in 1945, dropped to 8,116 units in 1946 and to 7,681 units in 1947. In 1948, production rose to 8,291 units; in 1949, to 10,059 units. (The rise in 1949 was due primarily to the introduction of the

* This report contains information available to CIA as of 31 December 1952.

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T-54 medium tank to serial production.) Production in 1950 was 10,348 units; in 1951, 10,950 units. Production in 1951 absorbed approximately 2 percent of the steel, 11 percent of the nickel, and 16 percent of the molybdenum produced in the USSR.

It is estimated that full mobilization in the Soviet Bloc would require some 76,000 tanks and assault guns. This demand could be met in part from the 1 January 1952 Soviet inventory of 59,398 units. The deficit of some 17,000 units could be made up by the six plants currently producing tanks and assault guns, which have a potential annual capacity of some 29,000 units, with a substantial margin to compensate for combat losses. Reconversion of other plants would not be necessary.

I. Introduction.

A. Definition and Description of Tanks and Assault Guns. 1/*

1. Definition.

A tank may be defined as an armored tracked combat vehicle possessing great mobility, fire power, and striking force. An assault gun may be defined as an armored tracked nonturreted vehicle used for direct-fire artillery support in the combat area. A tank is designed to close with the enemy and engage him in close combat. An assault gun, with its more powerful armament, is allowed by its armor to enter the combat area and engage in artillery support of the tank. The term "self-propelled gun" is often used interchangeably with assault gun. This usage is incorrect, however, because a self-propelled gun is no more than the name implies: an artillery piece normally used for indirect fire whose motive power is self-contained. The USSR is not known to have any such self-propelled guns.

Tanks and assault guns are usually classed as light,** medium, or heavy. This classification can be made on the basis of

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* Footnote references in arabic numerals are to sources listed in Appendix C.

** Since current Soviet production includes only medium and heavy types, reference to light tank or assault gun models will appear in this report only in the historical section which follows.

relative vehicular weights and gun calibers and also by combat mission. The light tank is primarily a reconnaissance vehicle; the medium tank combines moderately heavy armament and armor with great mobility and shocking power; and the heavy tank is the slugger of the three, designed with its heavier gun to deal with fortified positions and other tanks. Assault guns are classified to correspond with tanks of comparable weight whose chassis are used for their construction.

2. Description.

a. Tanks.

The main parts of a tank are the armored hull, the armored revolving turret, the armament, the engine, the transmission, and the suspension system. The armored hull provides protection for the crew and machinery. The turret provides for 360-degree employment of the armament, or fire power. The engine, transmission, and suspension system provide for the tank's mobility, speed, maneuverability, and cross-country performance.

(1) Armored Hull.

The armored hull is a rigid compartment composed of armor plate, or castings, welded or riveted together. In some tanks the hull unit is one large casting. Normally, the hull is divided into four compartments: driving, fighting, engine, and transmission. The arrangement of these compartments within the hull may vary, but the following arrangement is typical.

(a) Driving Compartment.

The driving compartment is located in the forward portion of the hull. It contains the driver and the mechanisms and instruments for controlling the tank's movement.

(b) Fighting Compartment.

The fighting compartment comprises the middle portion of the hull and the turret. Here is housed that part of the crew concerned with the direction of the tank's fire: the tank commander, the gunner, and the loader. This portion of the hull usually contains most of the ammunition and communications equipment of the tank.

(c) Engine Compartment.

The engine compartment, located directly to the rear of the fighting compartment, is separated from the latter by a hermetically sealed bulkhead in order to protect the crew from the toxic effect of exhaust gases and to prevent fires from spreading throughout the entire machine. This compartment contains the engine and certain auxiliary equipment, such as ventilators and radiators.

(d) Transmission Compartment.

The transmission compartment is located, in most instances, in the extreme rear of the tank and contains the various mechanisms which transmit power from the engine to the drive sprockets, which, when rotated, displace the tracks, causing the tank to move.

(2) Armored Revolving Turret.

The armored revolving turret contains the basic armament of the tank, which consists of a heavy caliber gun and one or more machine guns. In modern tanks the turret is a single casting and provides fire mobility in the horizontal plane by revolving on ball bearings through a complete circle. The horizontal rotation of the turret can be controlled either manually or by means of an electric or hydraulic motor.

(3) Armament.

The main armament of the tank usually is mounted in an armored shield, or mantelet. It is possible to turn the mantelet on its trunnions in order to allow movement of the gun in the vertical plane. In cases where two machine guns are located in the turret, one is mounted coaxially with the tank gun in order to assist in laying the main gun on the target. The second gun is usually mounted on top of the turret and is used for antiaircraft defense as well as for fire on ground targets.

(4) Engine and Transmission.

The engine in modern tanks is of the internal combustion type -- either a gasoline or a diesel engine. Because of the basic characteristics of internal combustion engines, the

crankshaft cannot be connected directly to the driving wheels or drive sprockets of the tank. Some auxiliary mechanism such as the transmission is required in order to vary the speed of movement in conformity with road conditions. The transmission may be a mechanical type, or it may employ fluids in varying degrees, as in hydraulic transmissions, torque converters, or cross-drive transmissions. In any event, the power is transmitted from the engine through a mechanical or fluid gear assembly to the differential and, by means of the final drive assembly, to the drive sprockets.

(5) Suspension System.

The suspension system consists of the running gear, suspension arms, and springs. The running gear consists of those parts providing for the actual movement of the vehicle, such as the tracks; the drive sprockets; the guide wheels (idlers), which guide the tracks and prevent them from falling off; the bogie wheels (road wheels), by means of which the hull rests on the tracks; and the support (return) rollers, which keep the upper segment of the tracks from sagging. The suspension arms connect the hull with the bogie wheels. The springs protect the hull from the shock caused by movement of the vehicle over rough terrain.

b. Assault Guns.

Assault guns generally are built on a tank chassis and, like tanks, have armor, armament, and tracked motive power. An assault gun, however, has more powerful armament than a tank in the same weight class. The increase in gun size necessitates a redistribution of weight and makes it impossible to use a turret. The lack of a turret leads to a decrease in fire mobility: that is, in the rapidity with which fire can be shifted from one target to another. To compensate further for the increase in armament weight, armor must be sacrificed by a reduction in armor thickness or by the elimination of all armor from less vulnerable places. The machine gun, when carried by an assault gun, serves primarily as a means of self-defense rather than as an instrument of attack. Therefore, machine guns either are completely lacking in an assault gun or are considerably fewer than in a tank. The assault gun differs from a tank in its tactical employment as well as in its construction.

B. Development of the Industry and the Product.

1. Prewar. 2/

The Red Army became acquainted with tanks for the first time in 1919, during the civil war, when it captured a French Renault tank from White Russian forces. In the fall of 1919 the Soviet of War Industry decided to construct its own tanks, using the captured Renault as a model.

Plans for the construction of this Soviet Renault tank were completed in January 1920, and production began in February at the Sormovo plant in Gor'kiy, now the Gor'kiy Krasnoye Sormovo Plant No. 112 imeni Zhdanov. The armor was produced by the Izhorskiy Steel Plant imeni Gor'kiy in Kolpino near Leningrad; the engine was manufactured by the AMO (Moskovskoy Automobil'noye Obshchestvo) plant in Moscow, now the Motor Vehicle Plant imeni Stalin; and the other parts were made by the Sormovo plant. Assembly of the first tank began at Gor'kiy in August 1920. So many problems were encountered that it was November before the tank was ready for testing, and December before it was actually delivered. Thus some 15 months were required for the production of this first Soviet tank. By March 1921, 15 of these 7-ton,* 34-horsepower (hp)** gasoline-powered units armed with a 37-millimeter (mm) gun had been produced. Thereafter, however, production was suspended as a result of the rapid mechanical failure of these units in the field.

Large-scale production of tanks began in the USSR in 1927, when the MS-1 (small escort) tank appeared. This tank was in many ways similar to the Renault tank, although embodying certain Soviet innovations. One special feature was the location of almost all of the final-drive components in the same housing with the engine, with a resulting economy in space. The MS-1 was the last Soviet tank to use a "tail," or open framework, on the rear to aid the tank in crossing obstacles.

During the late 1920's, extensive experiments were conducted to develop an original tank design. The appearance of the T-24 tank in

* Weights of Soviet tanks are given in metric tons, customarily and throughout this report.
** Horsepower of engines represents brake horsepower, customarily and throughout this report.

1930 was a direct result. The T-24 carried 20-mm armor, a 45-mm gun, and four machine guns and weighed 18.5 tons. One of the novel features of the T-24 was its three-level armament. In addition to hull armament, a small top turret rotated independently of the main turret, thereby making it possible to fire simultaneously in different directions. However, the increased height of the tank and the inevitable effect which the rotation of one turret had on the aiming of the other rendered this design unsatisfactory.

During the period of the First Five Year Plan (1928-32), the Soviet tank industry, conscious of its own backward technology, strove to assimilate foreign experience in the field and to adapt its designs to the capabilities of the automotive and tractor industries, which were growing rapidly. Tank development in the West during this period was featured by two different tendencies. French military authorities conceived the tank as a mobile fort which could advance with the infantry. Therefore, they constructed small, slow-moving escort tanks and ponderous powerfully armed and armored vehicles. UK and US military authorities saw tanks as modern cavalry and concentrated on highly mobile, thinly armored vehicles with comparatively weak armament. Forced to choose between the two concepts, Soviet authorities selected that of the UK and the US, which they held to be technically the more advanced. They reasoned that increasing the speed of a tank was a much more complex problem than that of strengthening the armor. To achieve high mobility, the designer had to solve all the problems inherent in the use of a powerful engine and a gear and suspension system capable of standing up under high speeds. According to a Soviet source, "It behooved Soviet tank construction to follow the path of constructing light, fast vehicles in order that later it might find its own independent means of combining high mobility with powerful armor and armament." Following this principle, the Soviet industry during the 1930's proceeded with the development of very small tanks, as well as light, medium, and heavy types.

The manufacture of very small tanks, or tankettes, was for the most part based on automobile construction (with automobile engine, transmission, and differential) and was begun with the production of the T-27 tankette (1932). The T-27, patterned after the British Carden-Lloyd tankette, combined one machine gun and 6-mm to 9-mm armor with a speed of 45 kilometers (km) per hour and a weight of 2.8 tons.

Tankette design took a turn toward amphibious tanks in this period, and in 1932 the Soviets produced the 3.5-ton T-37, which was

followed in 1935 by the very similar T-38. Still a third amphibious tank was released in 1940. This was the T-40, with 15-mm armor, two machine guns, and a weight of 5.8 tons.

The experimentation came to a close with the onset of World War II, when Soviet authorities recognized the necessity for heavier armor and armament. This necessity precluded the use of amphibious tanks and also halted the general use of tankettes by the USSR.

The first Soviet light tank of the 1930's (1932) was the T-26, which was patterned after the British 6-ton Vickers model. The T-26, with one 45-mm gun and one machine gun, had 15-mm armor and weighed 8.6 tons.

The high-speed wheeled-tracked BT light tank, based on a Walter Christie design, also appeared in 1932 and soon became standard in Soviet tank units. This vehicle possessed 15-mm armor, one 45-mm gun, and one machine gun and weighed 13 tons. Utilizing an interesting wheel-track combination, it was capable of 72 km per hour on wheels and 53 km per hour on tracks.

In 1941 the light tank T-60 appeared. This vehicle was virtually identical with the previously mentioned amphibious T-40 but was not amphibious. A further development of the T-60 was the light tank T-70, which was heavier and more powerfully armed. The T-70 carried a 45-mm gun and weighed 10 tons.

Like their predecessors, the T-60 and T-70 tanks were designed and built in a manner similar to the automobile. This similarity made possible the use of mass production methods and was to be of great value at the beginning of World War II, when the basic tank industry was transplanted to Eastern USSR. Because of the increased weight of the T-70, two automobile engines were installed in series to supply greater power. The light tank series proved to be too vulnerable, however, and the chassis was utilized as a basis for the creation of assault guns as the need for them became apparent during 1941-42.

Simultaneously with the continuous refinement and adaptation of foreign designs to Soviet specifications, the tank industry made considerable advancement toward its own original designs. In 1933-34 the medium T-28 and the heavy T-35 were produced. The three-

turreted T-28 with 20-mm armor was armed with one 76-mm gun and four machine guns. This tank had a crew of six and a speed of 40 km per hour. The five-turreted, 50-ton T-35 had 22-mm armor and was armed with one 76-mm gun, two 45-mm guns, and six machine guns. With a crew of nine, this vehicle was capable of 32 km per hour. Externally these two tanks resembled their respective British relatives, the 16-ton Vickers and Independent tanks. The internal machinery, however, was of Soviet design.

Immediately before the outbreak of World War II the Soviet tank industry produced its own completely original designs: the 32-ton medium tank T-34 and the 47-ton heavy tank KV. These two tanks incorporated certain improvements in design and technology. The use of steel castings in the manufacture of turrets and hull components greatly expedited mass production, marking the first use by the Soviets of castings for this purpose. The fact that the T-34 and KV had excellent cross-country performance characteristics in spite of their considerable weight was a result of using extremely wide tracks in order to distribute the ground pressure over as wide an area as possible. Powerful diesel engines were installed in these tanks for the first time in any mass-produced Soviet tanks. Their use not only provided a high unit power rating for these models (17.5 horsepower per ton for the T-34 and 14.5 horsepower per ton for the KV) but also meant an appreciable reduction in fuel consumption in comparison with gasoline engines. In addition, the fire hazard occasioned by the use of gasoline engines was greatly reduced. It is also worth noting that the KV was the first Soviet tank to utilize the torsion bar suspension system still in wide use today.

2. Wartime.

The saga of the tank industry during World War II is an eye-opening indication of Soviet industrial capabilities. The rapid advance of the German armies into the western part of the USSR in 1941 resulted in the loss of two of the largest tank plants (at Stalingrad and Khar'kov) and rendered a third useless (at Leningrad). These three plants had accounted for nearly 60 percent of prewar capacity. 3/ In spite of these reverses, the Soviet industry was able to produce 7,400 tanks in 1941. 4/ With personnel and equipment evacuated in late 1941 to the Urals area -- to Nizhniy Tagil, Chelyabinsk, and Sverdlovsk -- and to Omsk, in Siberia, it produced in 1942 14,500 tanks and 50 assault guns, or double the 1941 output. 5/ In 1943, production rose to 20,350 tanks and 2,500 assault guns and increased further in 1944 to a high point

of 16,700 tanks and 7,500 assault guns, or some 330 percent of 1941 production. 6/

This industrial feat was accomplished in spite of the loss of plants, skilled labor, and equipment and in spite of the chaos in the supply of raw materials and components. Production was further complicated by the fact that the development of heavier antitank weapons and heavier tank guns necessitated a constant increase in armament size and armor weight. 7/ As a result, there were frequent model changes which required more raw material per unit. In many cases, equipment used for the earliest production was not suitable for the construction of later models, for the new Soviet tanks and assault guns were a far cry from their much less complicated and lighter forebears. 8/

The 76-mm armament of the original KV heavy tank soon proved to be too light and was replaced by an 85-mm gun. The KV-85 was closely followed by the Joseph Stalin I (JS-I), which went into production late in 1943. The hull and suspension system of the JS-I were similar to the KV type, but the JS-I carried a 122-mm gun mounted in a massive cast turret. By the end of 1944 the JS-II appeared, and early in 1945 appeared the third in this series, the JS-III, characterized by the distinctive compound obliquity of the front, or glacis, plate. The JS-III participated in the assault on Berlin. Even in the postwar period it is considered by many to be the finest heavy tank in the world. 9/

The T-34 medium tank proved extremely successful in the early days of the war. German antitank weapons were too light to stop this tank from fulfilling its combat mission. 10/ In 1943 the first modification appeared. This was the T-34/85, or T-43, which substituted an 85-mm gun for the T-34's 76-mm gun. The second modification, the T-44, appeared in 1944. It incorporated several changes, including a lower silhouette, more frontal armor, and a better system of removing powder gases from the turret. This vehicle saw combat early in 1945. 11/

Soviet experimentation in the field of assault guns had been very limited prior to World War II, and the value of such weapons was not fully appreciated until the Soviet winter offensives of 1941-42. 12/ In early 1943, serially produced assault guns appeared for the first time. The SU-76 assault gun mounted a 76-mm gun on the T-70 medium tank chassis. Soon thereafter, a series of assault guns appeared which paralleled tank development and utilized the same chassis as the tanks.

Thus, in the medium field, the T-34 chassis was the basis for the SU-85 (85-mm gun), the SU-122 (122-mm gun), and the SU-100 (100-mm gun), which is the present standard issue medium assault gun. In the heavy field the KV chassis served as a basis for the JSU-122 and for the present standard, the JSU-152. 13/

3. Postwar.

The postwar development of the tank and assault gun industry may be divided into three periods. The first period extended from the cessation of hostilities in 1945 until the spring of 1947. It was characterized by the partial or total reconversion of plants that had been producing tanks and assault guns to the production of civilian articles and by extensive salvage operations. 14/ During this period a basic division of productive capacity was made between civilian and military items at the plants selected to continue tank and assault gun production. The second activity of this period, the salvage operation, has done perhaps more than any other single factor to cloud the picture of developments in this industry. At the cessation of hostilities, great quantities of equipment of all types were strewn over the landscape from Central USSR to Berlin. A program was initiated to salvage this equipment for its scrap value and to create serviceable items of equipment by cannibalization wherever possible. In many cases, only some casting and welding facilities were required, together with the necessary crane capacity. Since transportation was at a premium, these vehicles were taken to the nearest plant possessing the necessary facilities. This salvage activity gave rise to the many prisoner-of-war reports listing practically every metallurgical plant in this area as a "tank plant" and has complicated intelligence treatment of the industry ever since. 15/

The second period extended from the spring of 1947 until the spring of 1949. 16/ This period was taken up by the organization of the reconstituted industry and the reconstruction of plants in areas occupied by the Germans. The introduction of new methods and techniques that had been learned in the war but which were too extensive to initiate without interrupting war production was undertaken, as well as the establishment of more economic supply lines for component and raw materials than had been possible under wartime conditions. The basic items of production at this time continued to be the T-44 (and/or other modifications of the T-34/85) and the JS-III and the corresponding assault gun types, the SU-100 and the JSU-152. 17/ It is not known to what extent the T-44 became a

standard production item, but either the T-44 or other modifications of the T-34/85 were serially produced until the introduction of the T-54 in 1949.

The third and present period may be dated from May 1949, when serial production of the T-54 medium tank was undertaken at Nizhniy Tagil. 18/ Soon thereafter, it is believed, serial production of the T-54 was undertaken at other medium tank producing plants. The third period was marked by an increase in tank production, as the USSR sought to create a sufficient stockpile of new medium tanks to replace the aging and, by their standards, obsolete T-44, T-43, and T-34 mediums which were still either stockpiled or in the hands of troops. 19/

C. Interrelationship with Other Manufacturing Industries.

Before World War II the automotive and tractor industries were paramount in their contribution of finished and semifinished parts to Soviet tank production. The automotive industry furnished the engine and drive mechanisms, and the tractor industry contributed the suspension system. The hulls and turrets were constructed from a number of comparatively light steel plates which were bolted or welded together. Most of the tank parts were quite similar to automobile and tractor parts and, therefore, did not exceed the capacity of foundries, forges, cranes, and machine tools in these plants. 20/

The development of this industry and its product during World War II and in the postwar period has radically altered the position of the tank and assault gun industry in the economy of the USSR. Automobile engines, even when employed in series as in the SU-76 assault gun (the last to use a gasoline engine), proved to be inadequate in supplying the power needed for speed and cross-country mobility. The armored vehicles of today employ specially constructed, powerful, light-weight diesel engines of almost 1,000 hp. Instead of a number of individually light armor plates weighing perhaps 1,000 pounds apiece, modern tanks must have heavy castings weighing 10 or 15 tons apiece. 21/ The tractor suspension systems could not support the weight of these modern monsters, nor could the light automotive drive mechanisms adequately handle the power required to maneuver them. Only plants with the heaviest equipment can satisfy tank and assault gun requirements, for they alone possess the required foundries, forges, cranes, and machine tools.

The interrelationship of the tank and assault gun industry with the tractor and automotive industries no longer exists. It is to the locomotive plants and heavy equipment plants that the observer should look for the production of modern Soviet tanks and assault guns. At the present time, Soviet tanks and assault guns are produced in two heavy equipment plants, a locomotive plant, a railroad car plant, a mining machinery plant, and in buildings at Chelyabinsk specifically built for tank production.*

D. Organization of the Industry.

Little information concerning the organization of the Soviet tank and assault gun industry is available. When the bits and scraps of information available are coupled with the general pattern of Soviet industrial organization, however, it is quite logical to assume that such production is administered by an organization subordinate to the Ministry of Transport Machine Building of the USSR.

The tank industry started out under the auspices of the Soviet of War Industry in 1919. 22/ Little or no information is available concerning the organization of this industry during the 1920's and early 1930's. In 1937, and probably for some years previous, tank production was the province of the Peoples' Commissariat of Heavy Industry, which, in August 1937, became the Peoples' Commissariat of Machine Building. A decree of the Supreme Soviet dated 5 February 1939 subdivided this commissariat into three independent commissariats for heavy, medium, and general machine building. In 1942 the Peoples' Commissariat of Medium Machine Building became the Peoples' Commissariat of Tank Industry. 23/

The Peoples' Commissariat of Tank Industry consisted of several chief directorates, of which German intelligence identified only a chief directorate of supply and a transportation unit. 24/ The supply organization saw to it that the plants had an adequate supply of raw materials, machine tools, fuel, and so on, and maintained a number of regional offices to coordinate that supply. 25/ It is logical to assume the existence of a chief directorate for production, or some similar office, responsible for the actual production of armored vehicles.

On 15 October 1945 the tank commissariat disappeared again into a Peoples' Commissariat of Transport Machine Building. In March 1946 this organization assumed its present name, Ministry of Transport Machine

* See Appendix A, Gaps in Intelligence.

Building. 26/ This ministry is known to contain, among others, chief directorates for the production of locomotives, railroad cars, and diesel engines. 27/ There seems little doubt that it also has a chief directorate for tank production.

Centralization of production is one of the principal characteristics of the physical organization of tank and assault gun production in the USSR as contrasted with the US, where production is extremely decentralized. The US assembly plant does little more than combine completed components and subassemblies into the finished product. Thus a part such as the tank turret is cast in a foundry, shipped to a machine shop miles away for machining, after which it travels additional miles to the final assembly plant. For example, it was recently stated that one US tank track manufacturer has 23 subcontractors. 28/ The dispersion of production in the US is based upon a highly developed degree of specialization facilitated by excellent transportation facilities. A Soviet tank, on the other hand, almost literally develops from the iron pig to the finished product in one spot. The iron is made into steel, the steel is cast into the form desired, this casting is machined, the finished casting is incorporated into a subassembly, and the various subassemblies are incorporated into the finished product, all in one plant. 29/ With the exception of the armament and the engine, very little is subcontracted. During World War II, there were less than 100 plants in the USSR engaged in any way in the manufacture of tanks and/or tank parts.

II. Production.

A. Production Methods and Techniques.

An examination of the methods and techniques used in the USSR in tank and assault gun production is essential to a complete understanding of the capabilities of this industry and to a proper evaluation of intelligence information concerning armored vehicle production.

Soviet assembly methods underwent a radical change during World War II. During the first part of the war the workers moved rather than the work. Several hulls were lined up in an assembly hall, and the various components were introduced into these stationary hulls, as illustrated in Figures 1 to 5.* 30/ There was only a limited specialized division of labor; groups of workers moving from tank to tank welded the hull, installed the electrical system, mounted the

* Figures 1 to 5 follow this page.

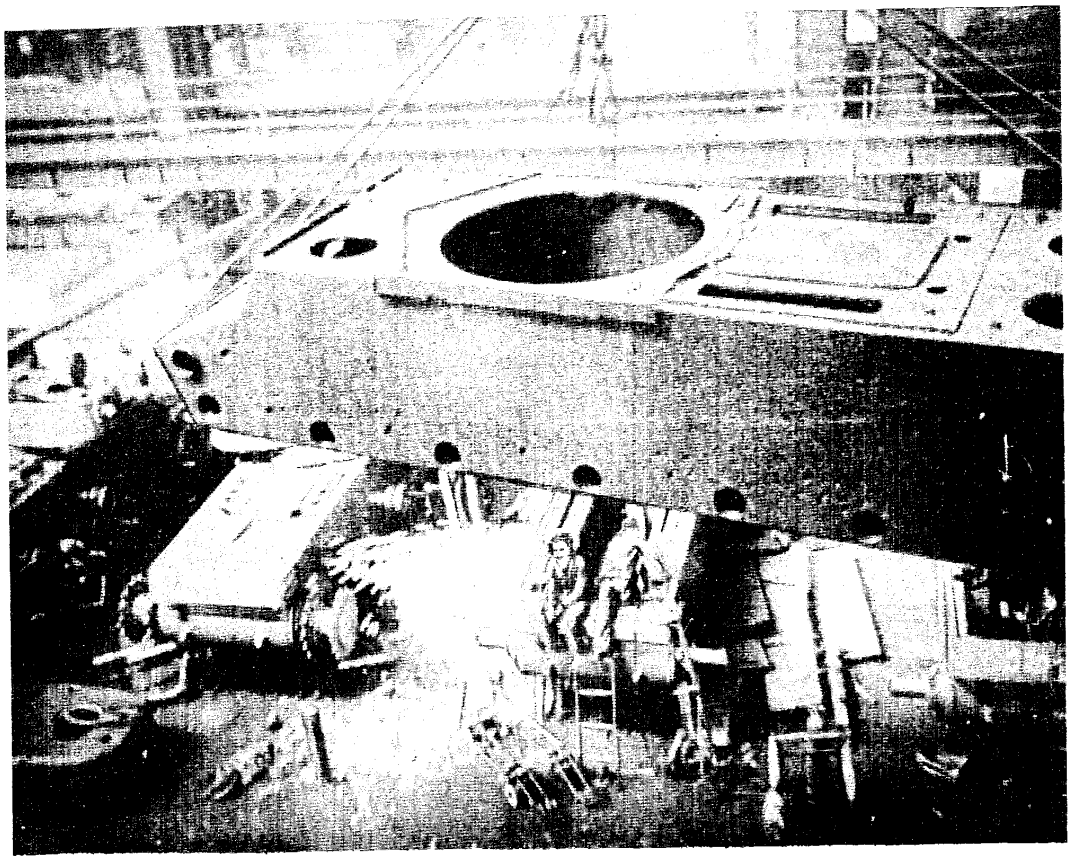

Figure 1. Tank Hull Construction on the KV-1 Tank at the Chelyabinsk Tractor Plant. (Note the use of the cutting torch in the foreground. This and the following photographs illustrate the preassembly line era of Soviet tank construction.)

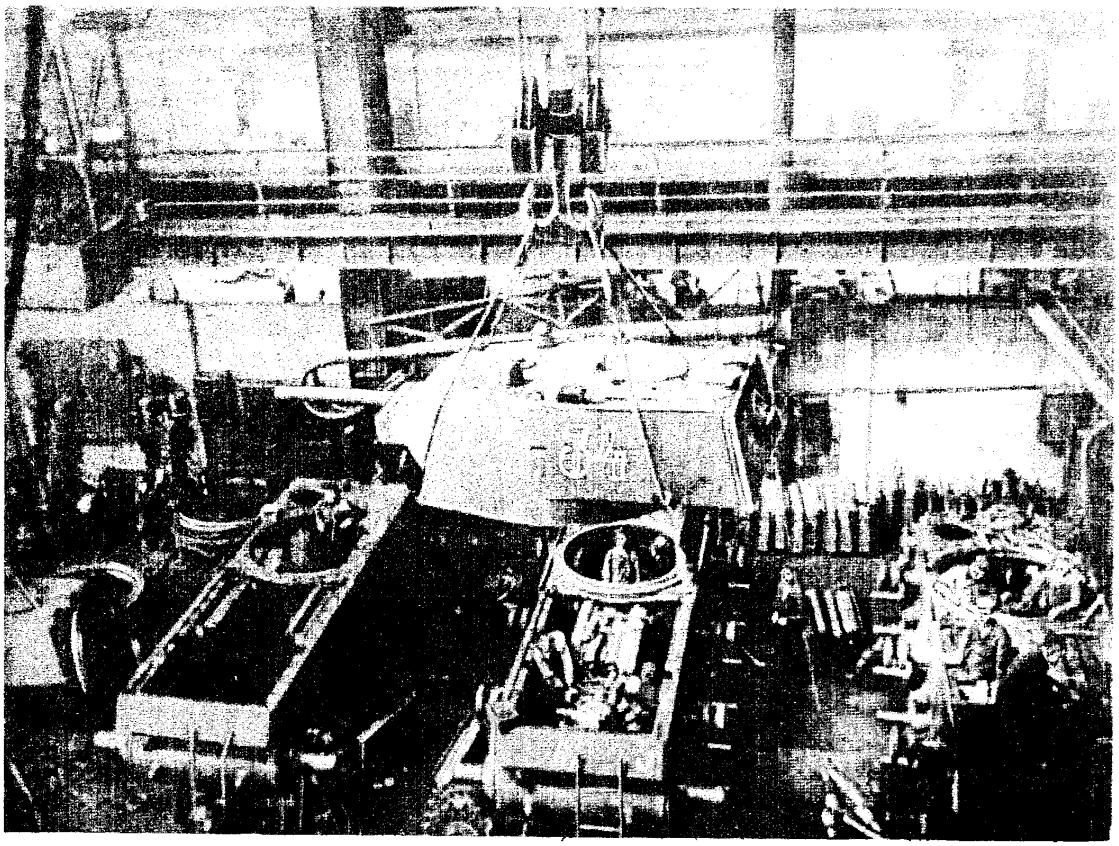

Figure 2. Mounting the Turret on the KV-1 Tank at the Chelyabinsk Tractor Plant. (Note the radiators stacked at right rear.)

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Figure 3. Installation of the Engine in the KV-1 Tank at the Chelyabinsk Tractor Plant.

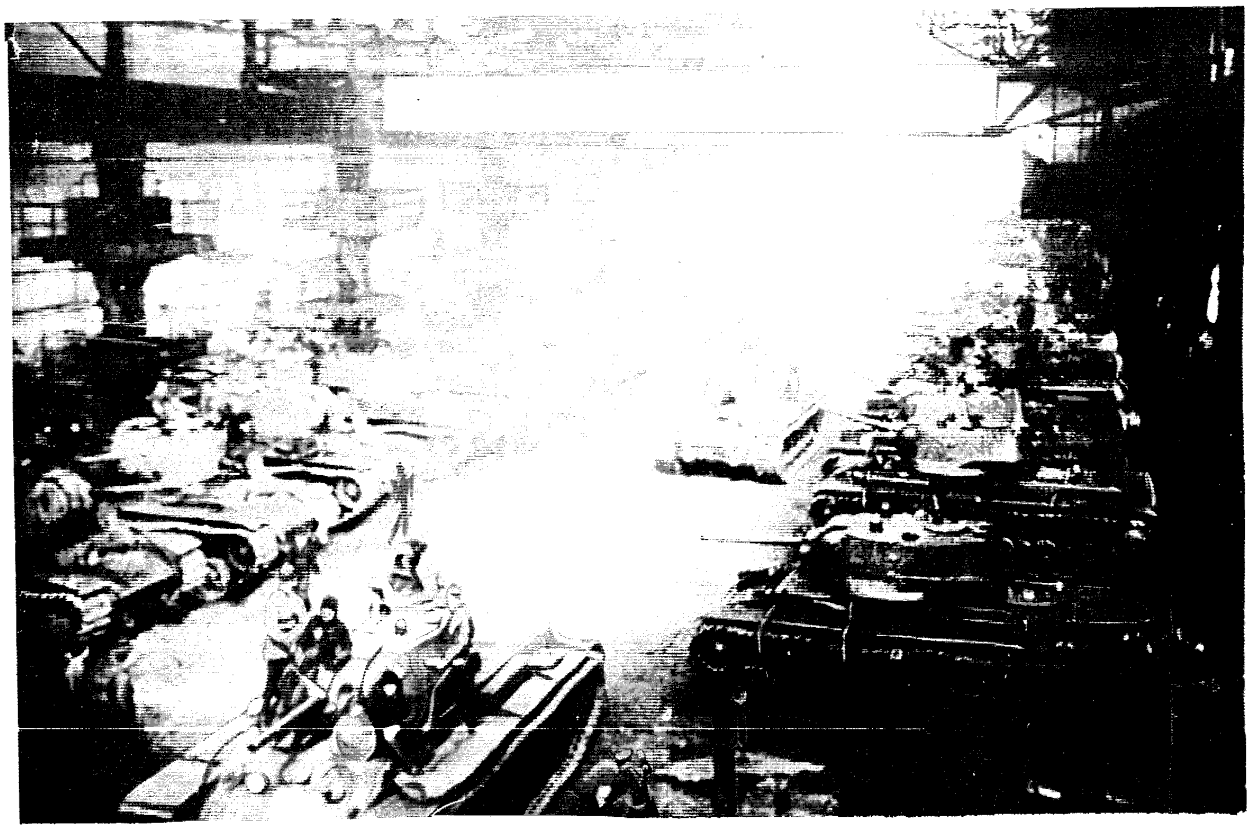

Figure 4. Completed KV-1 Tanks Being Removed from the Chelyabinsk Tractor Plant by Soviet Army Crews.
(Note the noncommissioned officer in the foreground with acceptance papers in hand.)

Figure 5. Completed KV-1 Tanks Standing at Chelyabinsk.
(Mechanical and Assembly Division 1 of the Chelyabinsk Tractor Plant appears in right rear.)

suspension system, and so on. However, in 1943-44 a drastic change occurred with the installation of conveyor assembly methods and a further specialization in the division of labor. Thereafter the work moved, and component parts were fed to strategic points along the assembly line and introduced into the tank as it moved along. Workers at the same time became increasingly specialized. Needless to say, the new method was a much more efficient way of doing things, and many Stalin prizes were awarded for its "discovery." 31/

A postwar technical innovation, widely used in the West, has been recently reported at the Soviet Army tank repair shops at Kirchmoeser, in East Germany. This innovation is the installation of a vertically revolving cradle for the tank hull, by means of which gravity welding may be used at any point on the hull. Although its use in the USSR proper has not yet been reported, there is little doubt that it is being used. 32/

The Soviet industry has followed Western example also in making increased use of automatic welding under flux, a technique which increases the welder's efficiency five or six times and produces excellent welds. By the end of World War II this process was in use at all plants in the USSR. At one of the largest Soviet tank plants, one-fourth of all hull welding and slightly less than one-third of all turret welding was done by automatic welding machines. The use of automatic welding in tank construction has undoubtedly increased in the postwar period. Mention was made in 1950 of the development of coiled electrode welding, in which the electrode is fed to the welding area from a coil mounted in the welding machine. 33/

There has been an increase in the size of castings used in tank construction in the USSR (as in the US). A Soviet writer mentioned in 1947 that the casting of complete hulls has been undertaken "recently." 34/ The US introduced complete hull castings in the mass production of tanks late in World War II. Use of these large castings reduces drastically the amount of welding required. There is also less scrap loss, because less machining is required.

The Soviet industry, even during World War II, possessed an excellent method of bonding rubber tires to road wheels, a method which may be found superior to US practice when more details are available. 35/ Another interesting innovation is the extensive use of aluminum castings in the diesel engine. For example, the block and crankcase are of aluminum. 36/

A recent analysis of a captured T-43 (T-34/85) Soviet tank produced some interesting conclusions. 37/ Generous use had been made of alloy steels and other quality materials. Manufacturing techniques were adequate. Finishes on nonessential surfaces were found to be excessively crude by US standards. A high degree of precision had been used in machining essential working parts. There was much evidence of comprehensive and detailed knowledge of the latest manufacturing techniques. This high level of technique, however, was not consistently applied in actual production. This inconsistency illustrates a very important point applicable to this industry: although Soviet research and development often may equal and on occasion may surpass US research and development, the application of techniques to mass production suffers by comparison with US practice.

B. Postwar Production.

A definitive estimate cannot be made of postwar production of tanks and assault guns in the USSR, because of gaps in available information. However, research has disclosed enough information to indicate the probable magnitude of the Soviet effort in this field.

1. Postwar Reconversion.

The first step in the consideration of postwar production is to establish which plants actually have been engaged in tank and assault gun production. Since World War II, nearly every heavy industrial installation has been reported at one time or another to be engaged in such production. It is first necessary, therefore, to assemble all the information available and to evaluate each plant in order to determine whether the plant is capable of producing tanks and whether or not it actually has been engaged in such production since World War II. The evaluation of some plants indicates that they produce only components. 38/ Others became associated with tanks during the general salvage period following the war. 39/ In other plants, tanks were received to be scrapped. 40/ Some plants did not have the equipment necessary to produce tanks. For example, a plant in Novaya Darnitza has often been reported as a tank plant. Investigation shows that this plant did not have forge and foundry facilities capable of handling large tank parts and that in fact it was a tank repair plant. 41/ In this manner the field has been narrowed to a few plants which are capable of producing tanks or assault guns and are believed to have been, in fact, producing them since World War II.

An exhaustive study of the plants considered to have engaged in postwar production discloses certain pertinent facts which have a bearing on such production. In the first place, each plant was historically a part of a larger industrial complex which utilized common transportation facilities and various other minor facilities for the production of several different end items. During the war these complexes produced tanks and/or assault guns and other military products. In the postwar period the complexes in question have produced tanks and/or assault guns together with civilian products. It should be noted, however, that the plant producing tanks and/or assault guns was and is for all intents and purposes a separate entity with its own management, labor force, equipment, and supply system. 42/ For this reason the "multimodel confusion factor," or the confusion and resultant loss of production caused by trying to produce different products in the same plant and over the same lines of equipment, does not apply here. Certainly the utilization of a single rail system and certain common facilities such as storage areas for coal and other raw materials -- as well as the mere fact of close proximity -- causes a certain amount of confusion and inefficiency. However, this is a problem the USSR faced both before and during the war, and it can be safely assumed that production in a particular plant of the complex is influenced by this factor no more now than it was then. It also has been determined from a detailed examination of each plant that, although certain modifications have occurred since World War II, these modifications were designed to make each smaller segment of the wartime plant more self-contained and more efficient. For example, a new tank diesel engine production shop was built at Chelyabinsk so that the tractor engine shop could return to its prewar location. 43/ However, changes in components facilities aside, no radical expansion of tank assembly line capacity is known to have occurred during the postwar period in any of the plants listed.

2. Postwar Rates of Production.

If it is known how many units were produced by a plant during a given period of World War II, and if it is known that such production then required a certain number of assembly lines of a certain capacity, and if it is known that certain of these assembly lines of known capacity have been engaged in the same production at a given time since World War II, then, all other conditions remaining the same (including the same relationship of production to capacity), it is possible to calculate the number of units produced during this given time. That is, if a given number of identical assembly lines could produce a certain number of units per month in World War II, then, if conditions have not changed since World War II, a smaller

number of assembly lines can now produce a proportionately smaller number of units per month. Since the Nizhniy Tagil Railroad Car Plant, for example, is known to have produced 21 tanks per day from 3 identical assembly lines during its peak sustained production period during World War II, it seems logical to conclude that, so long as the same conditions prevail, each of those 3 lines, if producing in the postwar era, is producing 7 tanks per day.

a. World War II Base.

Detailed information on Soviet production rates during World War II and on the number and characteristics of assembly lines in the various plants was obtained from the intelligence files of the German Army High Command in World War II (OKH Fremde Heere Ost). The German estimate of production rates was arrived at by three different methods --

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Stalin stated in 1946 that the Soviet tank industry had produced an average of 30,000 tanks, mechanized vehicles, and armored cars during the last 3 years of the war, or a total of 90,000 units. 44/ German calculations for 1943, 1944, and early 1945 plus the writer's calculations for the remainder of 1945 show a total production of some 65,000 tanks and assault guns. This production leaves 25,000 other mechanized vehicles and armored cars to be produced over the 3-year period to bring the total up to Stalin's not unambiguous figures. This figure checks against German information on Soviet armored car and mechanized vehicle production during World War II. 45/

b. Calculation of Postwar Rates.

(1) State of Information.

The foregoing investigation has established what is believed to be an accurate portrayal of the characteristics of each Soviet assembly line and the actual number of tanks or assault guns produced by each individual line during World War II. Direct intelligence information has permitted the determination of the status of these assembly lines in the postwar period up to the beginning of 1950. That is, it has been ascertained which lines have been producing tanks and assault guns since 1945 and when the assembly lines not retained for such production were converted to the assembly of other items. The status and essential characteristics of each wartime assembly line in the postwar period will be discussed in detail below. As already noted, German information gives the rate of production of each assembly line during World War II. Since it has been established which lines were in actual production in the postwar period, it is possible to calculate the number of units which were produced from 1945 through 1949, if the conditions prevailing in the industry during the war have not changed.

There is a great deal of information strongly indicating that in one important respect the industry continued to operate in the postwar period on the same basis as in World War II -- the labor force that was engaged in the manufacture of tanks and assault guns continued to work around the clock, though on the basis of three 8-hour shifts rather than on the World War II basis of two 12-hour shifts. Evidence to this effect is available for the period 1946-49. 46/ Although such evidence, taken by itself, does not show conclusively that World War II rates of production have been maintained to date, it is a strong indication that the USSR has been trying to utilize these facilities to the utmost.

There is very little direct intelligence information on tank and assault gun production from 1950 up to the present time; this lack of information is an important gap in US intelligence. Although little direct information is available on tank plants for the period 1950-51, however, direct information is available on the other plants in the complex which replaced the World War II plant. This information provides a basis for indirect deductions concerning tank or assault gun production in this period. For example, as of 1 January 1950, the Nizhniy Tagil Railroad Car Plant had two railroad

car assembly lines and one tank assembly line in operation. 47/ Certain possibilities exist concerning the operations of this complex since that date:

(a) Production of tanks has completely ceased, and the tank assembly line is idle.

(b) Production of tanks has completely ceased, and the tank assembly line is being utilized for railroad car production.

(c) Production of railroad cars has completely ceased, and the railroad car assembly lines are producing tanks.

(d) Production of railroad cars has completely ceased, and the railroad car lines are idle.

(e) The tank assembly line and/or the railroad car lines are producing some other products.

The information available on this plant for the period from 1950 to the present indicates that railroad car production continues at approximately the same rate as in 1949. 48/ This information makes possible the elimination of possibilities (b) through (d) cited above. There is no evidence that another product is being produced in these plants. This leads to the following hypothesis. The tank assembly lines in the various plants which were producing tanks or assault guns in 1949 are producing this product at present or they are standing idle. It cannot logically be assumed that these assembly lines are standing idle, in view of the announced Soviet intentions of utilizing labor and equipment to the utmost. 49/ Consequently, it seems logical to assume that these lines continue to produce tanks or assault guns. Nor does it seem likely, in view of the world situation, that production on these lines has been slowed down during this period. This reasoning, coupled with the facts which are available, can be applied to all the plants which were producing tanks or assault guns as of the end of 1949, as will be illustrated during the discussion of each plant which follows.

(2) Chief Variables.

Data from German intelligence files furnish a fairly comprehensive account of the Soviet tank and assault gun industry during

World War II. In the application of these data to the postwar period, an examination must be made of possible variables in order to determine their effect upon production rates in this period. Depending upon the magnitude of these variables and their net effect when balanced against one another, production from a particular assembly line may be greater or less than during the war. Available intelligence information is limited to the point that, although certain trends can be indicated, no precise determination of the magnitude of these trends can be made. Some of these trends would tend to increase, and some to decrease, production rates, and their net effect on assembly line rates or production represents the range of error in calculations made on the base of World War II production rates. Obviously, since the net effect of these trends is unknown, no precise range of error can be stated. It should be noted, however, that, with one exception, the chief variables -- labor, techniques and methods, plant equipment, product design, supply of component parts, weather, and scale of effort -- tend toward an increase in assembly line production rates. The assumption that postwar conditions affecting production rates have been the same as those prevailing during the war should therefore lead to estimates of postwar production rates that would be on the conservative side.

(a) Labor.

All of the assembly lines have been working three 8-hour shifts in the postwar period as opposed to the two 12-hour shifts worked during the war. 50/ The fatigue factor on an 8-hour shift is less than that on a 12-hour shift. Moreover, the wartime labor force of old men, young boys, and women has been replaced by returning veterans, who are presumably more efficient. It is conservative to assume that the postwar labor force is as efficient as the wartime force, since, as indicated, the postwar group probably is more efficient.

(b) Techniques and Methods.

The large-scale mechanization and modernization of Soviet tank manufacturing and assembly methods occurred during World War II and is reflected in the wartime production rates which form the basis of our calculations. These developments, therefore, do not constitute a postwar change to be reckoned with. 51/ However, certain postwar improvements would increase the efficiency of the assembly line, such as the introduction of large-scale use of tank hulls formed as a single casting, which would reduce the amount of welding to be done on the

line. 52/ It is therefore conservative to assume that technologically the assembly lines are as efficient as they were during the war.

(c) Plant Equipment.

Intelligence information indicates that the USSR is using automatic machinery to an increasing extent. 53/ Furthermore, the Soviets are turning to the use of increasingly higher-speed cutting by machine tools. 54/ It is logical to assume that these improvements are used on tank and assault gun assembly lines. Although this gain in efficiency would be dependent to some degree on the capacity of the foundries and forges which supply inputs to the machine shops and assembly lines, it still must be considered as increasing the efficiency of the assembly lines as compared with wartime standards.

(d) Product Design.

The tanks and assault guns produced at present are larger and more complex than those of World War II, particularly in the medium tank field. 55/ The introduction of the T-54 meant changes with which the labor force would have to become familiar, and it is probable that for some time this factor had a negative effect on assembly rates at the various plants. There is evidence that such items of equipment as stabilizing units are being installed in the various tanks. 56/ This and other developments would make the product more complex and correspondingly more difficult to assemble. It should be noted, however, that this factor affects the efficiency of the assembly line only in terms of the time required to install such a unit and not in terms of the time required to produce it.

(e) Supply of Component Parts.

Perhaps the most important variable in calculations of postwar production rates is the supply of component parts. Regardless of the efficiency of the assembly line, it cannot produce without component parts. It is known that both the plant and the Soviet Army have in operation within the plant inspection systems that are designed to insure the smooth flow of production. 57/ It is known that any failure to fulfill the Plan has dire consequences. 58/ A drastic failure to produce the required number of tanks or assault guns would have caused a radical shake-up in administration, and such a shake-up has not been reported. 59/ It is therefore conservative to assume that the supply of component parts to the assembly lines is at least as well

scheduled as was the case during the war, when the supply of component parts was complicated by the evacuation of supplier and producer plants from the combat area. 60/

(f) Weather.

Production, particularly the final acceptance procedure, is slowed to some degree during the winter months because of cold and snow conditions, especially at the Urals plants and at Omsk. 61/ However, the effect of this factor on postwar production should not have changed greatly since the war period.

(g) Scale of Effort.

Another important question is whether or not the assembly lines are being operated at less than capacity. There is no direct evidence either pro or con on this question. All indirect evidence indicates, however, that if a line is being operated at all, it is operated at capacity. The economy of the USSR is a planned economy. 62/ Therefore, when it is decided by Soviet authorities that a certain number of tanks and assault guns are to be produced during a specific period of time, the industrial capacity required to produce that number is specifically earmarked for such production. On balance it seems unlikely that more capacity is alloted than is required to fulfill the Plan. This argument is persuasive, not only because the USSR is known to be seeking to extract the maximum from its equipment and its skilled labor force, but also because the assembly lines producing tanks and assault guns have been reported as working around the clock. 63/ Therefore, there seems to be little reason to doubt that if a tank or assembly line is producing at all, it is producing at full capacity.

As has been previously stated, the magnitude of each of the variables listed above and their net effect on the rate of production from each assembly line cannot be determined from the intelligence data now available. On the basis of the reasons given above, however, it seems probable that each of the wartime assembly lines is producing more than it was during the war. It is probably conservative, therefore, to estimate postwar production on the assumption that the output of each assembly line is no greater than that of maximum sustained wartime production.

(3) Plant-by-Plant Estimates.

There follows a discussion of each postwar producing plant with emphasis on its tank and assault gun assembly lines, including a detailed explanation of the derivation of the daily production rates given in Table 1.*

(a) Nizhniy Tagil Railroad Car Plant No. 183 imeni Kaganovich.

The Nizhniy Tagil Railroad Car Plant is the largest medium tank producer in the USSR. German sources state that during the period of its highest sustained maximum production, this plant produced 21 medium tanks per day from 3 identical assembly lines. 64/ German covert operations and prisoner-of-war sources state that it required 97 hours for a tank starting on the assembly line to be carried through final acceptance at this plant. 65/ From an examination of the floor space devoted to the assembly line and from direct postwar information, it is estimated that each of the 3 lines can accommodate 28 tanks at one time. 66/ By dividing 97 hours by the 28 tanks on the line, it is found that the average time per tank position is 3.46 hours. The plant has assembled tanks on a 24-hour schedule both during the war and in the postwar period. On this basis the production of tanks at Nizhniy Tagil was computed at 24 ÷ 3.46 = 6.94, or, for all practical purposes, 7 tanks per day, from each of the 3 lines. This result checks with the German [redacted] analysis output of 21 tanks per day during the war. In the period June-July 1945, one of the assembly lines was converted to railroad car production. 67/ A second line was converted to such production in November-December of 1945. 68/ The remaining assembly line, which has been physically separated from the other two, has produced medium tanks up to the present time with such interruptions as are noted and cited in Tables 6 and 7, below.** Since work has proceeded on a 24-hour basis in the postwar period, it is calculated that on the average seven medium tanks per day were produced. On the basis of positive intelligence concerning railroad car production at this plant in April and July 1950 and in December 1951, it is assumed that the capacity applied to tank production is unchanged. 69/

* Table 1 follows on p. 25.
** Pp. 35 and 36, below.

Table 1

Summary of Data for Computing Soviet Production Rates for Tanks and Assault Guns

Units

	Nizhniy Tagil No. 183 Medium Tank	Chelyabinsk No. 178 Heavy Tank	Gor'kiy No. 112 Medium Tank	Leningrad No. 185 Heavy Assault Gun	Khar'kov No. 75 Medium Tank	Sverdlovsk Uralmash Tank	Sverdlovsk Uralmash Assault Gun	Omsk No. 174 Medium Tank	Gor'kiy imeni Molotov Assault Gun
Units of Wartime Daily Output	21	7-8	10	0	0	3	3	6	12
Estimated Units of Present Daily Output	7	3.5	0	6	4	0	3	6	0
Number of Wartime Production Lines	3	2	2	0	0	1	1	1	N.A.
Estimated Number of Present Production Lines	1	1	0	2	1	0	1	1	0
Hours Required to Transit Assembly Line	97	132	100	132	100	N.A.	100	98	N.A.
Units Required to Fill Assembly Line	28	20	20	18	18	N.A.	12	24	N.A.
Units of Output per Assembly Line per 24-Hour Day a/	6.9	3.6	4.8	6.5	4.3		2.9	5.9	

a. Units of output per 24-Hour Day = $\frac{24 \times \text{Units Required to Fill Line}}{\text{Hours Required to Transit Line}}$

(b) Chelyabinsk Tractor Plant No. 178 imeni Stalin.

Chelyabinsk is an excellent example of three independent plants in one combine (Kombinat). During World War II this plant -- or perhaps more properly these plants -- produced heavy and medium tanks and diesel engine accessories. 70/ The medium tank plant ceased production in the spring of 1944 and is today the tractor plant producing the S-80 tractor, while the accessories plant, Plant No. 255, continues production in the postwar period. 71/ The Chelyabinsk heavy tank plant is named for Stalin; its peak sustained production during the war was seven to eight tanks per day [redacted] 72/ It is estimated that the two heavy tank assembly lines accommodated some 20 tanks each. 73/ In this plant a heavy tank required 132 hours to traverse the final assembly line and final acceptance. 74/ Therefore, the rate of production by 1 assembly line may be computed at 132 ÷ 20 = 6.6; that is, 1 tank would come off the line every 6.6 hours. Each line was in operation 24 hours per day, and production could then be computed at 24 ÷ 6.6 = 3.6 tanks per day per line. The 2 assembly lines thus produced 7.2, or, for all practical purposes, 7 tanks per day. Information on tractor production at this plant in 1950 and 1951 indicates that the capacity devoted to tank production remained basically the same as it was during the first four postwar years. 75/

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(c) Gor'kiy Krasnoye Sormovo Plant No. 112 imeni Zhdanov.

According to German estimates the highest sustained production of the Krasnoye Sormovo plant at Gor'kiy was some five tanks per day from each of two tank assembly lines. 76/ It is estimated that each line accommodated 20 tanks, and that as was the case in the other medium plants, some 100 hours were required for a tank to traverse the assembly line and acceptance procedures in this plant. 77/ On this basis the rate of production by one line may be computed at 100 ÷ 20 = 5; that is, 1 tank would come off the line every 5 hours. The plant worked 24 hours per day. Production per line per day may thus be computed at 24 ÷ 5 = 4.8, or approximately 5 tanks. This plant was scheduled to be phased out of tank production. 78/ The first line was phased out in early 1946, and tank production had ceased altogether by March 1947, when the plant devoted its entire capacity to locomotive and river craft production. 79/ There is no production of tanks at this plant at the present time. 80/

(d) Leningrad Heavy Machinery Plant No. 185 imeni Kirov.

Although one of the chief tank producers in the prewar period, the Leningrad Heavy Machinery Plant No. 185 did not make much of a contribution to the wartime tank and assault gun production of the USSR. Most of the plant was evacuated to Chelyabinsk in September 1941, and the plant buildings were largely destroyed during the siege of Leningrad by the Germans. 81/ After the German tide had ebbed, reconstruction of the plant was gradually undertaken. In 1944 it was assigned the repair of damaged tanks and assault guns belonging to units on the northern front. 82/ From the scanty information available concerning the plant during the early postwar period, it is exceedingly difficult to determine just when this repair activity changed to the actual fabrication of new units. From what information is available, however, it is estimated that heavy assault gun production started in a somewhat desultory manner early in 1945. 83/ Production during the early postwar period was hampered by the fact that both this plant and its local suppliers were being reconstructed. Therefore, it is estimated that the first of the plant's two assembly lines did not reach full production until late in 1947; the second, not until June 1948. 84/ Based on its repair operations and postwar plant information, each of these lines is estimated to hold 18 assault guns. 85/ When operating at capacity, production of heavy assault guns in the other heavy plant requires some 132 hours from the start of assembly through final acceptance. 86/ The plant is working 24 hours per day, which means that the 18 tanks on each line would be finished in somewhat less than 6 days for a production rate of slightly over 3 per day per line. 87/ Production has been computed on this basis for the period beginning with June 1948, when production first reached capacity. Production in the earlier period (1945-47) was estimated in terms of the information available concerning the rate of reconstruction of the plant, and the estimate cannot be said to equal the accuracy of later calculations. Detailed information which would permit a more exact calculation of production for the period 1945-47 is lacking. Information concerning nonmilitary production at this plant, dated March, August, October, and December 1950 and April and November 1951, permits the conclusion that the capacity devoted to assault gun production remains basically the same as in 1949. 88/

(e) Khar'kov Locomotive Plant No. 75 imeni Komintern.

The Khar'kov Locomotive Plant No. 75, like the Leningrad plant, was located in a combat area, and for that reason its contribution to the Soviet production of tanks and assault guns during World War II was not significant. Before the war the plant area was occupied by two separate installations. Plant No. 183 produced locomotives and tanks, and Plant No. 75 produced diesel engines. 89/ In October 1941, Plant No. 75 was evacuated, and portions of the plant were moved to Sverdlovsk, Barnaul, and Rubtsovsk. 90/ At the same time, Plant No. 183 was moved to Nizhniy Tagil. 91/ With the capture of Khar'kov by the Germans, a tank repair center was established amid the ruins of the largely destroyed plant. 92/ When Soviet forces recaptured Khar'kov in 1943, they also used the plant area for a tank repair installation. 93/ From the information available, it is not clear just when this tank repair activity gave way to the actual manufacture of new units. Reconstruction of the greater plant area was undertaken in 1945 and was completed in 1947. 94/ The area, formerly occupied by Plant No. 183 and Plant No. 75, was redesignated as Plant No. 75, as the designation Plant No. 183 had remained at Nizhniy Tagil. 95/ Production of new medium tanks probably began at Khar'kov in July 1947. 96/ From wartime information on repair activity and postwar plant information, it is estimated that the one assembly line in operation at Khar'kov has an estimated capacity of 18 tanks. 97/ Assuming the 100-hour processing requirement prevalent in other medium plants, the rate of production may be computed at 100 ÷ 18 = 5.5; that is, 1 tank would be produced every 5.5 hours. The plant worked 24 hours per day. Production per day may thus be computed at 24 ÷ 5.5 = 4.3, or approximately 4 tanks. 98/ Slight variations from this figure during the first year of production were estimated on the basis of information concerning the rate of reconstruction at the plant. Information concerning locomotive production at this plant in October and November 1950 and in June and December 1951 permits the assumption that the capacity devoted to tank production in the period July 1947 has remained basically the same until the present. 99/

(f) Sverdlovsk Urals Heavy Machine Building Plant imeni Ordzhonikidze.

The Sverdlovsk Urals Heavy Machine Building Plant, commonly known as the Uralmash plant, and associated enterprises played a large part in the production of tanks and assault guns during World War II. With the beginning of the war in 1941, the plant began to

produce light tanks; in 1942 it converted to medium tank production. 100/ A second assembly line began producing the SU-85 assault gun in 1943 and by 1945 had converted to the production of the SU-100 assault gun. 101/ [redacted] show a peak sustained production of three tanks from the tank assembly line and three assault guns from the assault gun assembly line. 102/ The medium tank line was phased out in September 1945, when the plant began its reconversion to civilian production. 103/ The assault gun line continued to produce the SU-100 assault gun until May of 1946, when all armored vehicle production at this plant ceased. 104/ The assault gun line did not resume production until July 1948, although the use of plant rail facilities to remove a sizable stockpile of vehicles in the immediate area of the plant gave rise to many prisoner-of-war reports indicating production by the plant during the interim. 105/ This assault gun line has an estimated capacity of 12 assault guns. 106/ On the assumption that the 100-hour processing requirement prevalent in other medium plants applies here, the rate of production for 1 assembly line may be computed at 100 ÷ 12 = 8.33; that is, 1 tank would come off the line every 8.3 hours. The plant is known to be working 24 hours per day. Production per day may thus be computed at 24 ÷ 8.3 = 2.89, or 3 assault guns per day in the postwar period of calculation. Information on the production of civilian-type products in the spring of 1950, as well as in September and October 1950 and in January, June, October, and November 1951, permits the assumption that the capacity devoted to assault guns remains the same as that employed in 1949. 107/

(g) Omsk Plant No. 174 imeni Voroshilov.

Before World War II the site of Omsk Plant No. 174 was occupied by a large locomotive repair shop. 108/ This installation was augmented in 1941 by the evacuation from Leningrad of the original Plant No. 174 imeni Voroshilov, and an extensive plant expansion program was undertaken. 109/ During the war the peak sustained production rate at the Omsk plant was six medium tanks per day, [redacted] 110/ The single three-sectioned assembly line was 200 meters long and contained 24 tanks at one time. 111/ Some 98 hours were required for a tank entering the assembly line to proceed through the line and final acceptance processes at this plant. 112/ On this basis the rate of production may be computed at 98 ÷ 24 = 4.08; that is, 1 tank would come off the line every 4.08 hours. The plant operates 24 hours per day. Production per line per day may thus be computed at 24 ÷ 4 = 6, or 6 tanks. Information on Omsk has been

particularly scanty in the postwar period. Available information, however, indicates that the assembly line at Omsk continues to produce tanks. 113/

(h) Gor'kiy Automobile Plant imeni Molotov.

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[redacted] The Gor'kiy Automobile Plant, according to [redacted] had reached a sustained production rate of 12 SU-76 assault guns per day during the latter part of 1944. 114/ Such production ceased in May 1945, and the plant has not engaged in tank or assault gun production since that date. 115/

3. Postwar Annual Production.

The foregoing paragraphs illustrate the process by means of which daily production rates for each of the plants mentioned in the tables have been calculated. Soviet annual production of tanks and assault guns for the years 1945-51 is summarized in Table 2.* More detailed figures are given for each of these years in Tables 3 through 9,** on a monthly basis. The month has been chosen as the unit best suited to a detailed tabulation, since a daily tabulation would be artificial and cumbersome, and since [redacted] shows that the Soviet plants calculate production of these items on a monthly basis. To calculate monthly production, the daily production rate for each assembly line (as shown in Table 1***) was multiplied by the number of days in each month, although it should be recognized that no plant produces exactly the same number of units each month.

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It is conceivable that one or more entirely new plants completely devoted to tank and assault gun production have been constructed since 1950. In such an event the following estimates of production would be in error to the extent of the production of the new plant or plants. It should be emphasized, however, that no direct or indirect intelligence information indicates that any new installation of this type exists. Furthermore, in view of the fact that the current producers are each producing fewer tanks than they produced during World War II, it seems logical to expect that the USSR would reconvert

* Table 2 follows on p. 31.
** Tables 3 through 9 follow on pp. 32 through 38.
*** P. 25, above.

Table 2

Gross Soviet Production of Tanks and Assault Guns by Type
1945-51

Units

Type	1945	1946	1947	1948	1949	1950	1951	Total
Medium Tanks								
T-44 a/	11,877	6,095	5,457	4,668	3,296			30,393
T-54					2,718	5,603 b/	6,305	14,626
Medium Assault Guns								
SU-76	1,460							1,460
SU-100	1,971	180		204	1,095	1,095	1,095	5,640
Heavy Tanks								
JS-III	2,555	1,420	1,460	1,460	1,460	1,460	1,460	11,275
Heavy Assault Guns								
JSU-152	255	521	864	1,959	2,190	2,190	2,190	10,169
Total	18,118	8,116	7,681	8,291	10,059	10,348	10,950 c/	73,563

a. An unknown portion of the estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.
b. An unknown portion of this figure is T-44 or other model tanks, since the month of conversion to the production of T-54's is unknown for the Omsk and Khar'kov plants.
c. It should be noted that the total production figure for 1951 is considerably higher than the latest published estimate of OAC/S G-2, Department of the Army, which is 6,000 to 7,500. 116/

some of the World War II tank and assault gun assembly lines which are now engaged in nonmilitary production before constructing entirely new facilities. As has been pointed out, such reconversion has not occurred. The possibility of completely new tank plant construction, however, cannot be entirely ignored on the basis of logic or negative intelligence.

Table 3

Soviet Tank and Assault Gun Production
1945

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	620	560	620	600	620	600	434	434	420	434	420	217	5,979	Medium (T-44) a/
Chelyabinsk No. 178	217	196	210	217	217	210	217	217	210	217	210	217	2,555	Heavy (JS-III)
Gor'kiy No. 112	310	280	310	300	310	300	279	279	270	248	240	217	3,343	Medium (T-44) a/
Leningrad No. 185	15	15	15	20	20	20	20	20	25	25	30	30	255	Heavy (JSU-152)
Khar'kov No. 75 Sverdlovsk Uralmash	248	224	217	210	217	210	186	155	120	93	60	31	1,971	Medium (SU-100)
Omsk No. 174	217	196	217	210	217	210	217	217	210	217	210	217	2,555	Medium (T-44) a/
Gor'kiy imeni Molotov	370	350	370	370									1,460	Medium (SU-76)
													2,810	Heavy
													15,308	Medium
Total	1,997	1,821	1,959	1,927	1,601	1,550	1,353	1,322	1,255	1,234	1,170	929	18,118	

a. An unknown portion of the estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.

Table 4

Soviet Tank and Assault Gun Production
1946

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	217	210	217	210	217	217	210	217	210	217	2,555	Medium (T-44) a/
Chelyabinsk No. 178	124	92	124	120	124	120	124	124	120	124	120	124	1,420	Heavy (JS-III)
Gor'kiy No. 112	186	168	186	140	110	80	80	80	80	80	80	80	1,350	Medium (T-44) a/
Leningrad No. 185	28	30	31	30	31	40	45	48	54	60	62	62	521	Heavy (JSU-152)
Khar'kov No. 75														
Sverdlovsk Uralmash	40	35	40	35	30								180	Medium (SU-100)
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-44) a/
													1,941	Heavy
													6,175	Medium
Total	781	699	784	715	689	630	652	655	644	667	652	669	8,116	

a. An unknown portion of estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.

Table 5

Soviet Tank and Assault Gun Production
1947

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	217	210	217	210	217	217	210	217	210	217	2,555	Medium (T-44) a/
Chelyabinsk No. 178	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Heavy (JS-III)
Gor'kiy No. 112	80	80											160	Medium (T-44) a/
Leningrad No. 185	60	50	60	64	68	72	76	76	79	83	86	90	864	Heavy (JSU-152)
Khar'kov No. 75							93	93	90	93	90	93	552	Medium (T-44) a/
Sverdlovsk Uralmash														
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-44) a/
													2,324	Heavy
													5,357	Medium
Total	667	607	587	574	595	582	696	696	679	703	686	710	7,681	

a. An unknown portion of the estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.

Table 6

Soviet Tank and Assault Gun Production
1948

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	a/	a/	24	28	62	93	150	186	210	217	1,383	Medium (T-44) b/
Chelyabinsk No. 178	124	112	124	120	124	120	124	124	120	124	210	124	1,460	Heavy (JS-III)
Gor'kiy No. 112														
Leningrad No. 185	105	115	130	145	180	180	186	186	180	186	180	186	1,959	Heavy (JSU-152)
Khar'kov No. 75	93	84	93	90	93	90	93	93	90	93	90	93	1,095	Medium (T-44) b/
Sverdlovsk Uralmash							2	3	15	31	60	93	204	Medium (SU-100)
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-44) b/
													3,419	Heavy
													4,872	Medium
Total	725	675	533	535	607	598	653	685	735	706	840	899	8,291	

a. Two months are required for conversion from one model to another. 117/ Although it is not believed a conversion took place at this time, it is reported that production was delayed for reasons yet obscure.
b. An unknown portion of the estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.

Table 7

Soviet Tank and Assault Gun Production
1949

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	a/	b/	31 c/	45	155	186	190	217	210	217	1,664	Medium (T-44, T-54) d/
Chelyabinsk No. 178	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Heavy (JS-III)
Gor'kiy No. 112														
Leningrad No. 185	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Heavy (JSU-152)
Khar'kov No. 75	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Medium (T-44) d/
Sverdlovsk Uralmash	93	84	93	90	93	90	93	93	90	93	90	93	1,095	Medium (SU-100)
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-44) d/
													3,650	Heavy
													6,409	Medium
Total	930	840	713	690	744	735	868	899	880	930	900	930	10,059	

a. 118/
b. 119/
c. Beginning of T-54 production.
d. An unknown portion of the estimated T-44 production may include other modifications of the T-34/85. The differences are principally in component parts.

Table 8

Soviet Tank and Assault Gun Production
1950

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	217	210	217	210	217	217	210	217	210	217	2,555	Medium (T-54)
Chelyabinsk No. 178	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Heavy (JS-III)
Leningrad No. 185	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Heavy (JSU-152)
Khar'kov No. 75	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Medium (T-54) a/
Sverdlovsk Uralmash	93	84	93	90	93	90	93	93	90	93	90	93	1,095	Medium (Unknown Assault Gun)
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-54) a/
													7,300	Medium
													3,650	Heavy
Total	930	840	930	900	930	900	930	930	900	930	900	930	10,950	- - - - - - - - - -
													-602	Correction Factor a/
													10,348	Net

a. Date of conversion from T-44 to T-54 is unknown; therefore, a correction factor equal to the loss of 2 months' production due to such conversion is applied. 120/

Table 9

Soviet Tank and Assault Gun Production
1951

Units

Plant	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total	Models
Nizhniy Tagil No. 183	217	196	217	210	217	210	217	217	210	217	210	217	2,555	Medium (T-54)
Chelyabinsk No. 178	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Heavy (JS-III)
Leningrad No. 185	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Heavy (JSU-152, JS-III)
Khar'kov No. 75	124	112	124	120	124	120	124	124	120	124	120	124	1,460	Medium (T-54)
Sverdlovsk Uralmash	93	84	93	90	93	90	93	93	90	93	90	93	1,095	Medium (Unknown)
Omsk No. 174	186	168	186	180	186	180	186	186	180	186	180	186	2,190	Medium (T-54)
													7,300	Medium
													3,650	Heavy
Total	930	840	930	900	930	900	930	930	900	930	930	930	10,950	

C. Potential Productive Capacity.

The potential productive capacity of the USSR for the manufacture of tanks and assault guns can be stated as the sum of the following: (1) the total capacity of current producers, including the reconverted capacity now used for other purposes; (2) the total capacity, after reconversion, of World War II producers not now engaged in armored vehicle manufacture; and (3) other capacity that could be converted to tank and assault gun manufacture, together with the capacity of any newly constructed plants.

The potential capacity of the Soviet plants now engaged in the manufacture and assembly of tanks and assault guns was calculated on the basis of the total productive capacity of their individual assembly lines as described in the preceding section. For plants not presently producing tanks and assault guns, potential capacity is estimated on the basis of wartime performance.

The plants that now produce tanks and assault guns and the plants with World War II experience in such production, together, possess the capacity to supply the USSR with some 43,000 tanks and assault guns per year, as will be seen below. The subdivision of this figure into tanks and assault guns by model would be determined by the military situation at the time and is impossible to predict. By the same token, a classification as to medium or heavy units has not been undertaken. It should be noted, however, that medium models have become so heavy that they require much the same facilities as heavy models.

1. Total Capacity of Current Producers.

The total capacity of plants now engaged in the production of tanks and assault guns is indicated in Table 10.* It was calculated on the basis of total wartime assembly line capacity as described in the preceding section.

2. Capacity of World War II Plants Since Converted to Civilian Production.

Some of the plants which gained technical and production experience in the manufacture of tanks and assault guns during World War II could readily be reconverted to this use.

* Table 10 follows on p. 41.

The Krasnoye Sormovo Plant No. 112 in Gor'kiy, which ceased medium tank production in March 1947, is quite capable of reconversion to such production. It now produces locomotives and river craft. 122/

The Stalingrad Tractor Plant imeni Dzerzhinskiy in Stalingrad has not produced tanks since 1941, when its labor force and equipment were evacuated to Eastern USSR. After its recapture by Soviet forces, it served as a tank repair center, as it did to some extent in the postwar cannibalization and clean-up period. It is now engaged in tractor and diesel engine production. 123/ Although tank production machinery of the plant was either destroyed or evacuated, and although the tank that it produced in 1941 bears little resemblance to those of today, its proximity to the Krasnyy Oktyabr Steel Plant and the Krasnyy Barrikady Armament Plant No. 221, both in Stalingrad, makes it a potential producer with a capacity based on the size of the plant. 124/

The Kirov Plant imeni Kuybyshev produced assault guns until 1944, and the Moscow/Mytishchi Railroad Car Plant No. 40 until 1945. 125/ The Gor'kiy Automobile Plant imeni Molotov ceased production of assault guns in May 1945. 126/ It should be pointed out that these three plants produced the SU-76 assault gun, whose light construction and dual automobile engines are quite different from the heavier diesel types in vogue today. The potential production capacity of these plants has been figured on the basis of the lighter, less complicated wartime production. Actual production would, it is felt, be considerably less, as reconversion to production would be quite difficult and would extend conversion lead time considerably.

Table 11* gives the capacity of World War II plants that have been wholly converted to civilian production.

3. Additional Capacity from Further Conversion and New Plant Construction.

The USSR possesses a sizable capacity for further increases in the production of tanks and assault guns, in the form of locomotive and heavy equipment plants. It seems unlikely, however, that such additional capacity would be devoted to the production of tanks and assault guns, since there are other important requirements that must be met by such capacity, and since, as is shown in III, below, there appears to be no need for such additional capacity to produce more tanks and assault guns.

* Table 11 follows on p. 41.

Table 10

Capacity of Current Soviet Tank and Assault Gun Producers

Plant	Units per Year Capacity
Nizhniy Tagil No. 183	7,665
Chelyabinsk No. 178	6,570
Leningrad No. 185	5,400
Khar'kov No. 75	2,920
Sverdlovsk No. 9	2,190
Omsk No. 174	4,380
Total	29,125

Table 11

Capacity for Producing Tanks and Assault Guns of Soviet Plants Converted to Civilian Production since World War II

Plant	Units per Year Capacity
Gor'kiy No. 112	3,650
Stalingrad imeni Dzerzhinskiy	3,500 a/
Kirov imeni Kuybyshev	1,320
Moscow/Mytishchi No. 40	900
Gor'kiy imeni Molotov	4,800
Total	14,170

a. Estimated.

III. Supply and Demand for Product.

This section will consider military demands for tanks and assault guns and the ability of the USSR to meet these demands from production and inventory. The effect of demand on production is modified by inventory, or stocks on hand: therefore, after a consideration of demand, the inventory level will be determined. Finally, the net effect of demand on new production will be explored in order to weigh the present and future ability of the industry to satisfy demand.

A. Demand for Product.

There is a very definite limit to the demand for tanks and assault guns. This limit is determined by the extent to which the USSR can provide the crews and fuel for the vehicles and transport them to the area of combat. Demand is also limited by the number of armored units which can be effectively employed in conjunction with the correct proportions of other arms or branches of the armed forces in order to insure the greatest tactical and strategic returns for the investment. Needless to say, the greatest magnitude of demand would be for a supply sufficient to outfit the totally mobilized armed forces, and it is this demand which will be considered here.

Soviet plans for total mobilization are believed to be based on the premise that such mobilization would be completed in 360 days, or M-day plus 360. 127/ It is estimated that the demand for tanks and assault guns during this period would not exceed 61,000 units. 128/ It is further estimated that the Satellites would require some 15,000 units for the expansion to contemplated wartime status. 129/ Therefore, it is likely that demand for the product would not exceed 76,000 units during the year of total mobilization.

B. Tank and Assault Gun Inventory.

The demand for tanks and assault guns can be met in part from an inventory of some 59,000 units on hand as of 1 January 1952. In order to judge the extent to which this inventory can satisfy demand, Tables 12 and 13* have been prepared to show both its magnitude and its composition. These tables were constructed from the production estimates given above. Order-of-battle information [redacted] constitute an independent means of checking the accuracy of these data.

25X1B4d

* Table 12 follows on p. 45; Table 13, on p. 46.

Table 12 shows the production, depreciation, and inventory of tanks and assault guns for the USSR for the period 1945-51, inclusive, by year. A short statement on the mechanics and the construction of this table is in order. The starting figure of 15,150 units as of 1 April 1945 was taken from German staff studies. 130/ This figure was derived by the Germans from order-of-battle information, [redacted] In many cases the raw material used by the Germans in preparing this estimate is available, and the estimate is believed to be reasonably accurate. In any case, the effect on current inventory figures of any error in the German estimate is lessened by deductions for depreciation during the 7 years since the war.

25X1B0b

With this figure as a starting point, each succeeding year's production is entered and depreciated on a yearly basis. Production in any given year was assumed not to have begun depreciating until the following year. Depreciation includes vehicles disappearing from the inventory through scrapping, cannibalization, or complete destruction in use and is subtracted from beginning inventory plus production to secure year-end inventory. Depreciation is calculated for each year separately, since it is obvious that a tank produced in 1945 would depreciate more rapidly during 1950 than a tank produced in 1949. Another advantage of depreciation according to age is that the relative age of the units comprising the inventory can be shown.

The depreciation percentages themselves were arrived at after examination of the wartime experiences of all nations involved in World War II and consultation with various agencies on peacetime rates. 131/ For tanks and assault guns produced during the years 1945-51, depreciation was estimated to commence at a rate of 6 percent per year and increase 1 percent for each succeeding year. The units on hand on 1 April 1945, however, were wartime products, and most had seen combat. Depreciation for these wartime units, therefore, was estimated to be 20 percent during 1945 and 1946, to be 15 percent during 1947, to be 10 percent during 1948, and to have increased 1 percent per year over the 1948 figure thereafter. Little direct information is available concerning actual Soviet tank and assault gun depreciation rates.

It may be argued that obsolescence is also a factor in depreciation. The fact that the Soviets produce a later and more modern vehicle certainly indicates that the earlier model is technically obsolete. However, the full practical ramifications of this obsolescence are obscure. For example, although the T-54 renders the T-44 technically

obsolete, there can be little doubt that the Soviet Army will use the T-44's until they are completely depreciated in the manner noted above. Therefore, for the purpose of this inventory, it will be assumed that a vehicle is not obsolete until it is scrapped, cannibalized, or destroyed -- that is, until a new model replaces it completely and no further old models are in the hands of troops.

Table 13 shows the composition of the park, or inventory, in terms of specific models as of 1 January 1952. This table was prepared as follows. Table 12 indicates the portion of each year's production which remained to form the inventory as of 1 January 1952. The composition of each year's production by model could be calculated. (See Table 2.*) Since no available information indicated that any particular model depreciated more rapidly than the rest, the composition by model of each of the age groups comprising the 1 January 1952 inventory was assumed to correspond to the composition by model of the original production.

Determination of the composition by model of the group of vehicles that remained from the starting figure of 15,150 on 1 April 1945 was more difficult. A portion of this group had been produced during the first 3 months of 1945, and its composition by model could be determined from Table 3.** After a consideration of wartime losses the remainder of the group was taken to be comprised of one-third 1943 production and two-thirds 1944 production. Composition by model of production in 1943 and 1944 was known from German studies. 132/ Therefore, composition by model of those units remaining from the starting figure of 15,150 was figured by applying the percentages by model of the original years' production as outlined above.

Although the Satellites possess a motley inventory of wartime German, US, and British models together with some of the older Soviet types, this inventory does not play an important role in this discussion of demand versus supply. The former group is being replaced as rapidly as possible, and the Soviet types are included in the Soviet park, since our calculations are based on Soviet production minus depreciation, regardless of the disposition of production. 133/ Because production in the Satellites is negligible, it also has no bearing on the problem at hand. 134/

* P. 31, above.
** P. 32, above.

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Table 12

Soviet Tank and Assault Gun Production, Depreciation, and Inventory
1 April 1945 - 1 January 1952

Units

Year	Production	Dep. Dur. 1945 a/	Rem. End 1945 b/	Dep. Dur. 1946	Rem. End 1946	Dep. Dur. 1947	Rem. End 1947	Dep. Dur. 1948	Rem. End 1948	Dep. Dur. 1949	Rem. End 1949	Dep. Dur. 1950	Rem. End 1950	Dep. Dur. 1951	Rem. End 1951
Wartime Stockpile as of 1 Apr 1945	15,150	3,030	12,120	2,424	9,696	1,454	8,242	824	7,418	816	6,602	792	5,810	755	5,055
1945 (1 Apr-31 Dec)	12,341		12,341	740	11,601	812	10,789	863	9,926	893	9,033	903	8,130	894	7,236
1946	8,116				8,116	487	7,629	534	7,095	567	6,528	588	5,940	594	5,346
1947	7,681						7,681	461	7,220	505	6,715	537	6,178	556	5,622
1948	8,291								8,291	497	7,794	546	7,248	580	6,668
1949	10,059										10,059	604	9,455	661	8,794
1950	10,348												10,348	621	9,727
1951	10,950														10,950
Total	82,936	3,030	24,461	3,164	29,413	2,753	34,341	2,682	39,950	3,278	46,731	3,970	53,289	4,661	59,398

a. Dep. Dur. means depreciation during year indicated.
b. Rem. means remaining at the end of the year indicated.

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Table 13

Soviet Tank and Assault Gun Inventory by Model and Class
1 January 1952

Model	Number of Units	
	Model	Class
Light Tanks		
T-70	84	84
Medium Tanks		
T-34	210	
T-43 (T-34/85)	1,708	
T-44 (or modifications)	~~22,895~~ 20953	
T-54	13,928	36,799
Heavy Tanks		
KV-1	20	
KV-85	52	
JS-I	21	
JS-II	168	
JS-III	8,787	9,048
Medium Assault Guns		
SU-76	1,060	
SU-85	116	
SU-100	3,918	
SU-122	84	
SU-152	21	5,199
Heavy Assault Guns		
JSU-122	63	
JSU-152	8,205	8,268
Grand Total		59,398

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ST/PC

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CORRECTION

To holders of CIA/RR PR-25, The Tank and Assault Gun Industry of the USSR, 27 February 1953

Page 46, Table 13, under Number of Units, Model, entry for Medium Tanks, T-44:

For 22,895 read 20,953

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C. Demand versus Supply.

Summarizing the foregoing portions of this section, a maximum demand by the military under conditions of mobilization for some 76,000 tanks and assault guns can be met in part from the Soviet inventory of some 59,000 units as of 1 January 1952. As previously stated, the Soviet concept of practical obsolescence is a very simple one: a unit is not obsolete until it falls apart or a new one arrives to replace it. Therefore, practically speaking, the degree of obsolescence of the inventory, although of some concern from a research, development, and production point of view, has no practical effect on the use of the existing inventory. Hence there is a deficit of some 17,000 units to be supplied from new production during the year of mobilization. Combat losses during this year would also have to be replaced from current production. The magnitude of these combat losses would be dependent on both the type and the size of military operation undertaken and the resistance encountered.

In the preceding section on production the current producers of tanks and assault guns were shown to have an annual capacity of some 29,000 units, if they devote their full capacity to such production. This figure would be affected, of course, by conversion lead time. Even without recourse to plants not now producing tanks or assault guns, therefore, the industry is capable of supplying the maximum demands made on it by the military, if combat losses do not exceed some 12,000 units during the year of mobilization, or some smaller figure if -- as is almost certain -- production during the first year of mobilization cannot immediately be brought to capacity.

IV. Input Requirements.

A US manufacturer has completed an engineering analysis of the Soviet T-34/85 or T-43 tank. 135/ This report gives the finished weight and chemical composition of the various component parts of this tank. By using the chemical analysis, it was possible to estimate the weight of each of the materials comprising the finished weight of any particular part.

A. Metals.

The metals contained in the T-34/85 constitute the bulk of its finished weight. The metallic inputs computed on the basis of the US

manufacturer's analysis are shown in Table 14.

Table 14

Metallic Finished Weights for the T-34/85 Tank

Metal	Pounds per Unit Finished Weight
Steel	61,156.82
Manganese (as Ferromanganese)	1,150.98
Aluminum	1,000.00
Silicon (as Ferrosilicon)	607.61
Copper	441.00
Nickel	532.66
Chromium (as Ferrochromium)	463.97
Lead	455.00
Zinc	79.00
Molybdenum (as Calcium Molybdate)	77.87
Tin	27.00
Magnesium	7.02
Titanium	0.97
Tungsten	0.10
Total	66,000.00

Finished weight, because of losses in process, is of course not equal to input weight. The exact weight of the metallic inputs for Soviet tanks and assault guns is unknown. The methods used to manufacture the various component parts, however, are known, and the percentages of yield for various industrial processes could be estimated. 136/ This estimate permitted the computation of input factors -- that is, the total amounts of material which were needed to begin production in order to end with the previously calculated finished weights of the various materials which comprise the T-34/85 tank, as shown in Table 14. The results of this calculation are shown in the first column of Table 15.*

* Table 15 follows on p. 49.

Table 15

Metallic Inputs Required for Soviet Tank and Assault Gun Production
1951

Pounds per Unit

Material	Yield Percentage	Tank or Assault Gun				
		T-34/85	T-54	JS-III	SU-100	JSU-152
Steel	70 a/	87,366.89	113,576.96	148,523.71	78,630.20	131,050.33
Manganese	60	1,918.30	2,493.79	3,261.11	1,726.47	2,877.45
Aluminum b/	80	1,250.00	1,250.00	1,250.00	1,250.00	1,250.00
Silicon	60	1,012.68	1,316.48	1,721.56	911.41	1,519.02
Copper	60	735.00	955.50	1,249.50	661.50	1,102.50
Nickel	100	532.66	692.46	905.52	479.39	798.99
Chromium	90	515.52	670.18	876.38	463.97	773.28
Lead	90	505.55	657.22	859.44	455.00	758.33
Zinc	90	87.77	114.10	149.21	78.99	131.66
Molybdenum	100	77.87	101.23	132.38	70.08	116.81
Tin	90	30.00	39.00	51.00	27.00	45.00
Magnesium	80	8.76	11.39	14.89	7.88	13.14
Titanium	90	1.07	1.39	1.82	0.96	1.61
Tungsten	100	0.10	0.13	0.17	0.09	0.15

a. The percentage given reflects the fact that a considerable part of the steel used in tank production is processed in plants having their own steelmaking facilities. The yield percentage is therefore higher than it would be in plants without their own steelmaking facilities. The steel used in tanks is principally in armor steel castings. Gates and risers are reclaimed in the next heat.
b. Engine input of aluminum common to all models.

It was necessary, and seemed reasonable, to assume that the ratio between the finished weight of the T-34/85, for which metallic input data could be calculated, and the finished weight of each of the various models in current production would be approximately the same as the relative weight of their material inputs. With the finished weight of the T-34 expressed as 1.0, the weight of the T-54 would be 1.3, and that of the JS-III would be 1.7. The finished weight of the JSU-152 assault gun would be 1.5, and that of the SU-100 would be 0.9. 137/ Allowance was made for various parts common to all models,

such as batteries. Using the input weights of the T-34/85 as a basis, it was then possible to calculate input weights for tanks in current production. The method outlined above has been used in the preparation of Table 15.

B. Nonmetallic Materials.

1. Rubber.

As in the case of the metallic input factors, finished weight data for rubber were available only for the T-34/85. 138/ These weights are indicated in Table 16.

Table 16

Rubber Input Requirements for the T-34/85 Tank

	Pounds per Unit
Rubber	Weight
Natural	
Bogie Wheel Tires (10 at 58 pounds)	580
Miscellaneous	20
Neoprene	
Miscellaneous	25
Buna S	
Suspension Arm Bumpers	20
Ammunition Cushions	10
Miscellaneous	10
Total	665

It was necessary to apply these figures to the models currently produced. In the base of rubber products, the natural rubber utilized in the suspension systems constitutes the majority of all rubber used,

and the synthetic rubber inputs used for equipment such as seat cushions were assumed to be common to all models. The yield for rubber was taken to be 100 percent.

In the case of the T-54 and SU-100, a direct parallel was possible. On this basis, inputs could be calculated for these models at 580 pounds of natural rubber and 85 pounds of synthetic rubber. Since the heavier models such as the JS-III and the JSU-152 utilize a different suspension system, however, it was necessary to devise a method by means of which the known input of natural rubber in the T-34/85 could be applied to the determination of natural rubber input for the heavier models. It is interesting to note that, although there is no information on the models themselves that indicates the use of rubber coverings for suspension members, plant analysis has shown that such covering processes were employed in a plant producing heavy units exclusively. It can therefore be assumed that the road wheels and return rollers on the heavy models are rubber covered. 139/ Inputs for the heavier models were determined by comparing their surface areas with the corresponding rubber-covered surface area of the T-34/85. In the case of the JSU-152 and the JS-III, 12 road wheels at an estimated 38 pounds of rubber each, and 6 return rollers at 19 pounds of rubber each, totaled some 570 pounds of natural rubber. This figure, when added to the estimated 85 pounds of synthetic rubber, produced a rubber input factor of 655 pounds per heavy unit.

2. Plastics and Fabrics.

Again, a lack of information required the utilization of data available on the T-34/85, shown in Table 17.* 140/

The problem of translating these data into input factors for all models again presented itself. The yield was taken to be 100 percent. The use of finished weight ratios, in the manner used to determine metallic input factors, is much less accurate in this application. Lack of information, however, compels its use. In terms of fabric input factors, the application of finished weight ratios gives 34.2 pounds for the T-54, 23.7 pounds for the SU-100, 44.7 pounds for the JS-III, and 39.5 pounds for the JSU-152. The use of plastics is negligible for all models.

* Table 17 follows on p. 52.

Table 17

Plastic and Fabric Inputs for the T-34/85

Item	Plastic and Fabric Input (Pounds per Unit)
Injection Pump Connector Disc	Negligible
Antenna Insulator	Negligible
Compressed Air Tank Valve Knob	Negligible
Turret Electrical Supply Slip Ring	Negligible
Battery Cell Case	Negligible
Driver's Head Bumper	Negligible
Cotton Insulation on Wiring (459 feet)	26.3

C. Effect of Materials Input Requirements on the Economy.

Now that the unit input factors have been established for the various tank and assault gun models currently produced, it would be informative to consider the total effect that production of these items would have on the economy of the USSR. Production of tanks and assault guns for 1951 was estimated to consist of 6,205 T-54's, 2,190 JSU-152's, 1,095 SU-100's, and 1,460 JS-III's. The input of materials required to produce these units is shown in Table 18.*

Technical Branch,G-2, GSUSA, Department of the Army, has estimated Soviet 1951 production of tanks and assault guns at 3,700 T-34/85's, 900 SU-100's, 700 JS-III's, and 700 JSU-152's, for a total production of 6,000 units. 142/ The effect of such production on the economy of the USSR is illustrated by Table 19.** These figures were computed by the use of CIA input figures and G-2's production estimate.

D. Electrical Energy.

No figures have ever been published on the number of kilowatt-hours (kwh) required to produce an armored fighting vehicle. But considerable information is available on items with related requirements, such as locomotives, tractors, trucks, and other heavy equipment,

* Table 18 follows on p. 53.
** Table 19 follows on p. 54.

Table 18

Total Metallic and Nonmetallic Input Requirements
for Soviet Tank and Assault Gun Production
1951 a/

Metric Tons

Material	Tank or Assault Gun				
	T-54	SU-100	JS-III	JSU-152	Total a/
Steel	319,595.1	39,054.7	98,360.0	130,182.4	587,192.2
Manganese	7,017.3	857.6	2,159.7	2,858.4	12,893.0
Aluminum	3,517.4	620.9	827.8	1,241.7	6,207.8
Silicon	3,704.4	452.7	1,140.1	1,509.0	6,806.2
Copper	2,688.6	328.6	827.5	1,095.2	4,939.9
Nickel	1,948.5	238.1	599.9	793.7	3,580.2
Chromium	1,861.5	230.4	580.4	768.2	3,440.5
Lead	1,849.4	226.0	569.1	753.3	3,397.8
Zinc	321.1	39.2	98.8	130.8	589.9
Molybdenum	284.8	34.8	87.6	116.0	523.2
Tin	109.7	13.4	33.8	44.7	201.6
Magnesium	32.0	3.9	9.8	13.1	58.8
Titanium	3.8	0.5	1.2	1.6	7.1
Tungsten	0.4	0.0	0.1	0.2	0.7
Rubber	1,871.2	33.0	433.8	650.7	2,988.7
Fabrics	96.3	11.8	29.6	39.2	176.9
Plastics	Negligible	Negligible	Negligible	Negligible	Negligible

a. On the basis of this estimate, approximately 2 percent of the total steel produced in the USSR during 1951 was required for the production of tanks and assault guns. The other most significant inputs, in terms of percent of total Soviet production of those materials, are nickel (11 percent of Soviet production) and molybdenum (16 percent of Soviet production). Several other inputs run over 1 percent of Soviet production of those materials. 141/

Table 19

Total Metallic and Nonmetallic Input Requirements
for Application to Estimate
of Soviet Tank and Assault Gun Production
by Technical Branch, G-2, GSUSA
1951

Metric Tons

Material	Tank or Assault Gun				
	T-34/85	SU-100	JS-III	JSU-152	Total [a]
Steel	146,628.64	32,099.78	47,159.10	41,610.28	267,497.80
Manganese	3,219.50	704.81	1,035.46	913.64	5,873.41
Aluminum	2,097.89	510.30	396.90	396.90	3,401.99
Silicon	1,699.59	372.07	546.63	482.32	3,100.61
Copper	1,233.56	270.04	396.74	350.06	2,250.40
Nickel	893.97	195.70	287.52	253.69	1,630.88
Chromium	865.20	189.41	278.27	245.53	1,573.66
Lead	848.47	185.75	272.89	240.78	1,547.89
Zinc	147.31	32.25	47.37	41.80	268.73
Molybdenum	130.69	28.61	42.03	37.09	238.42
Tin	50.35	11.02	16.19	14.29	91.85
Magnesium	14.70	3.22	4.73	4.17	26.82
Titanium	1.80	0.39	0.58	0.51	3.28
Tungsten	0.17	0.04	0.05	0.05	0.31
Rubber	1,116.08	271.48	207.97	207.97	1,803.50
Fabrics	44.14	9.68	14.19	12.54	80.55
Plastics	Negligible	Negligible	Negligible	Negligible	Negligible

a. According to this estimate, approximately 1 percent of the total steel produced in the USSR during 1951 was required for the production of tanks and assault guns. The other most significant inputs, in terms of percent of total Soviet production of those materials, are nickel (5 percent of total production) and molybdenum (7 percent of total production). 143/

and enough work has been done to date (for ORR Project 37.6) to permit a reasonable provisional estimate of these requirements. 144/ It is estimated that some 40,000 kwh are required to produce a medium armored fighting vehicle and some 60,000 kwh are required for a heavy unit. 145/ Therefore, for the 1951 production of 7,300 medium units and 3,650 heavy units, a total of 511 million kwh would be required per year.

E. Manpower.

Published information indicates that during World War II the production of a T-34/85 medium tank required 3,700 man-hours, and the production of a KV heavy tank required 7,200 man-hours. 146/ This is assumed to be a direct labor input. Information in the postwar period does not indicate that any major change in man-hour requirements has taken place. Factors leading to increased efficiency, such as new production techniques and the elimination of uneconomic factors produced by wartime conditions, are counterbalanced to some extent by increased labor requirements of the heavier and more complex models now in production.

On the basis of a production of 7,300 medium units and 3,650 heavy units per year, the total annual direct manpower requirements would be 53,290,000 man-hours. A Soviet worker is believed to put in 2,500 man-hours per year. 147/ Translating our requirement in man-hours to number of workers would mean that some 21,316 full-time direct workers were required. Actually 117,000 workers devote at least part of their time to tank and assault gun production as such. 148/

F. Transportation.

A total of 375 million ton-kilometers was required for the production of 10,950 tanks and assault guns in 1951. This figure was obtained (in preliminary work on ORR Project 37.6) by determining the suppliers of components and raw materials to the finishing plants and then computing the weight of the particular part or material and the distance from the supplier to the finishing plant by rail. 149/

G. Petroleum Products.

It has been estimated (in connection with ORR Project 37.6) that a total of about 90,000 metric tons of petroleum products was required for the 1951 production of tanks and assault guns in the

finishing plants. 150/ This requirement represents a small fraction of 1 percent of total production of petroleum products by the USSR, which has been estimated at 35.5 million metric tons in 1951. 151/

V. Vulnerabilities and Intentions.

A. Vulnerabilities of the Industry.

The Soviet tank and assault gun industry produces a simple product as compared with similar items in other countries. There is little effort to install intricate devices which would be hard to produce, install, and maintain and which would require a large amount of technical knowledge and training on the part of the crew.

Supply of electric power constitutes a vulnerability which this industry has in common with most other industries. The use of approximately 11 percent of the nickel and approximately 16 percent of the molybdenum produced in the USSR for the production of 10,950 units is significant. The lack of antifriction bearings is not a vulnerability common to this industry; however, the use of 88 antifriction bearings in the T-34/85 tank shows the demand made by this type of product on the antifriction bearing industry. 152/

B. Intentions concerning the Industry.

The intentions of the Soviets regarding the tank and assault gun industry appear to be threefold: to continue the advances of the USSR in armored vehicle development, to replace present tank and assault gun holdings with more modern equipment, and to maintain sufficient operating and potential capacity to support the Soviet Army in any operation it might undertake.

With respect to over-all Soviet intentions, the information used in preparing this report does not indicate any significant trends in the tank and assault gun industry. The rise in medium tank production in 1949 seems prompted more by the decision to put the T-54 into general production than by any specific international developments. This industry has a much higher rate of production at all times than has been the case in the US. Although the conclusion should not arbitrarily be drawn that the USSR is preparing for war, it does mean that hostilities can be initiated with much less preparation and a shorter lead time than would be required in the US.

APPENDIX A

GAPS IN INTELLIGENCE

The security system surrounding the production of armored vehicles in the USSR is extremely efficient. For this reason, complete information on the equipment and production processes employed for such production is lacking in many cases. Information on the equipment and production of military and civilian end items at the Sverdlovsk, Nizhniy Tagil, and Chelyabinsk plants is much more abundant than such information on Leningrad and Khar'kov. Information on the Omsk plant, and in fact on the entire city of Omsk, has been extremely scarce in the postwar period.

A second gap in intelligence is the lack of detailed and technical information on tank and assault gun models other than the T-34/85. Detailed information on the size, method of manufacture, and composition of the component parts of the JS-III, JSU-152, and other models would aid in the determination of productive capacity of the equipment involved, and also in the more concrete identification of such parts with a specific model.

A third gap in intelligence is a lack of information to determine what methods are used by the USSR to maintain its sizable park of tanks and assault guns, what percentages are declared obsolete and destroyed, and what success is obtained in protecting vital parts such as wiring, batteries, and optical equipment. Such incidents as a German panzer division immobilized because rats ate the insulation off the wiring systems of their Tiger tanks, and the US mothballing of Essex-class carriers to prevent corrosion only to find that the lack of moisture in the air destroyed the entire wiring systems, raise the question as to whether all the tanks and assault guns the Soviets expect to reclaim from stockpiles will operate when the time comes.

Finally, a decided lack of information for 1950 and 1951 constitutes the greatest gap of all in intelligence. Specific and detailed gaps in intelligence have been mentioned throughout the text.

APPENDIX B

METHODOLOGY

The purpose of this report was to give a picture of the armored vehicle industry and its impact on the economy of the USSR, with particular emphasis on input factors. From the point of view of methodology, this purpose involved the determination of the individual material input requirements for the different models produced, and then the determination of the number of models of that specific type produced in each of the plants involved.

There was a complete lack of detailed input information. However, a US manufacturer had prepared an engineering analysis of the Soviet T-34/85 tank. This report, cited above in the text, approached the tank from an engineering point of view; however, it was possible to obtain input information from basic data given in the report. For example, the report gave the finished weight of certain parts and the chemical analysis of the part. With these facts it was possible to compute the weight of the various chemical components of the part. A total of the component weights for a particular material would then indicate the finished weight of that raw material required for the T-34/85 tank. From the industrial processes known through plant analysis to be used in the manufacture of that part in the USSR, it was then possible to arrive at a yield percentage for that raw material and the input factor for that raw material. In a like manner the total inputs for the T-34/85 were derived.

The lack of detailed information on the models currently produced necessitated alloting inputs proportionately by weight in relation to the T-34/85 except in cases where the components were common to all models, such as the battery, or common to other models, such as the suspension systems.

With the individual unit inputs established, it was then necessary to compute the number of individual units produced in each of the plants. The methodology used to calculate production is outlined in the text, as are other methods used in the preparation of the report.

APPENDIX C

SOURCES AND EVALUATION OF SOURCES

1. Evaluation of Sources.

For the purpose of correctly evaluating the sources of intelligence used in the preparation of this report, there must be considered the repatriated prisoner of war, the defector, or the agent who furnished the basic information and also the collection agencies that extracted and transmitted the information.

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A thorough survey of the files of the former German General Staff and the files of the various German Army groups has also been made. Whatever errors German intelligence made in World War II on the strategic level and in the political sphere, their tactical and operational intelligence has proved to be quite accurate. In the case of the armored vehicle industry, marginal notes and comments have added to the extensive picture available. Here again, the industrial approach with emphasis on equipment and processes renders the time lag much less important than would normally be the case. Further information on the German data used and their reliability can still be obtained from the staff who prepared the documents.

Statements in the Soviet press have been used, and these assume surprising significance when seen against the background of an industrial and operational approach.

The evaluation of collection agencies must consist of an evaluation of the use made by the collector of the raw material available to him, since the analyst is not in a position to gauge the total amount of raw material as opposed to that exploited. To these comments it may be added that the main deficiency in collection seems to be a stress laid on quantity rather than quality.

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